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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
WERNER, BRIAN P	
ART UNIT	PAPER NUMBER
2621	

DATE MAILED: 06/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/848,479	Applicant(s) GUEST ET AL.	
	Examiner Brian P. Werner	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 25 March 2003 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 50-72 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 50-72 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 03 May 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Response to Amendment

2. Commensurate with the filing of the RCE, the amendment filed on March 25, 2003 has been entered. All previous claims have been cancelled, and new claims 50-72 are now pending.

Claim Objections

3. The following quotations of 37 CFR § 1.75(a) is the basis of objection:

> (a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

4. Claims 54 and 69-72 are objected to under 37 CFR § 1.75(a) as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery.

Claim 54 (line 3) lacks an antecedent basis for "the anomalous region". "An" anomalous region will be assumed for examination purposes. Formal correction is required.

Claims 69-72 (lines 1-2 of each claim) lack an antecedent basis for "identifying the region over which the slope of the histogram data changes". It appears that these claims should depend from another (i.e., missing) claim that establishes the generation of a histogram. The following will be assumed for claim 69 (and equivalently for claims 70-72): The method of claim 67 wherein <u>the determining step comprises</u> identifying [the] <u>a</u> region over which the slope of [the] <u>a</u> histogram [data] changes [comprises] <u>by</u> identifying ...". Formal correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claim 56 is rejected under 35 U.S.C. 102(e) as being anticipated by Schemmel et al. (US 5,943,55a A).

Schemmel discloses an apparatus (figures 1A, 1B, 3A and 3B) comprising:

a camera ("CCD camera" at column 5, line 50) generating digital image data of two or more dies ("a random chip matrix 37 of randomly selected silicon chips 42, are scanned ..." at column 5, line 36); and

a reference die detection system receiving the images and generated reference die image data ("... create a statistical die model or "standardized" silicon chip matrix" at column 5, line 40; "statistical die model" at column 8, line 33);

storage storing the reference die image data ("database" at column 8, line 36; the die model is stored for subsequent comparison during the analysis phase; see "compares" at column 6, line 43); and

where pre-stored reference die image data is not used to generate the reference die image data (the dies used to generate the reference die image data are "randomly selected" and statistically combined as described at column 5, lines 35-40 and column 8, line 34; thus, no pre-stored image data is used).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 50-52, 57, 58, 67, 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A) and Schemmel et al. (US 5,943,55a A).

Regarding claims 50, 67 and 68, Sumie discloses selecting a reference die ("the reference image" at column 7, line 50) comprising:

a die image comparator (figure 6, numeral 3a) creating a difference image by subtracting ("difference is calculated pixel by pixel" at column 5, line 31; figure 7, numeral S2) a first die image ("reference image" at column 5, line 29) and a second die image ("inspection image" at column 5, line 28); and

a difference image analysis system (figure 6, numeral 4; figure 7, numeral S4-S5) determining whether the first die image and the second die image may be used as the reference die without using a pre-stored reference die image (Sumie relies upon a "reference image" of a semiconductor die for comparison with an inspection image for purposes of determining a defect in the inspection image. The reference image is stored in memory 3c of figure 6. Sumie discloses how the reference image is selected at column 7, lines 50-56, wherein he states, "the reference image data ID_c to be stored in the image memory 3c of the image processor 3 ... may be data of an image obtained by picking up an image of a portion of the surface of the semiconductor wafer where there is no defect". Phrased differently, Sumie states that "when an image of the semiconductor wafer 1 in a position where no defect exists is further picked up to use as a reference image, the 'position including no defect' which is output from the defect inspection apparatus may be used for the image pickup operation as the position of the reference image" at column 9, line 1. Thus, Sumie performs an inspection operation on the wafer in order to determine a position on the wafer where a defect free reference image can be found, and then uses the defect free image as the reference image.

Sumie discusses how this is done, specifically in relation to the inspection of semiconductor dies, at column 8, lines 46-60. Sumie states, "in the case of a semiconductor wafer on which the same construction (die) repeatedly appears, a defect portion can be extracted by comparing the pieces of luminance ... of the dies with each other" at column 8, line 50. Regarding the comparison of at least two dies for purposes of determining if a defect exists, Sumie states, "when the same part of three dies is extracted by the inventive method, if the pieces of luminance information ... substantially agree within a specified tolerance, no defect is determined to exist in the test regions of the three dies" and if the luminance "extracted from one die differ from those extracted from the remaining two dies, a defect exists in the test region of this one die" at column 8, line 58. Thus, Sumie compares at least two die images, as called for by the claims [i.e., the claims are open ended], in order to determine whether a defect exists, and then uses a defect free dies as the reference image); and

storing the reference die image in a memory (the reference image is stored in memory 3c of figure 6).

Regarding claim 51, Sumie disclose an imaging system creating a digital image (figure 6, numeral 2).

Regarding claim 52, Sumie disclose an image store (figure 6, numerals 3b-3g).

Regarding each of the above claims, while Sumie selects a defect free die as a reference die based on the comparison of at least first and second die images as described immediately above, <u>Sumie does not teach combining the first and second die images to form the reference die image</u>.

Schemmel discloses system in the same field of die inspection ("detection of defects in individual silicon chips" at column 1, line 8), and same problem solving area of forming a reference die ("... create a statistical die model or "standardized" silicon chip matrix" at column 5, line 40; "statistical die model" at column 8, line 33), comprising combining first and second die images to form the reference die image ("a statistical die model matrix is obtained" and "mean gray scale values for each neighborhood of pixels" at column 8, lines 33-38; at least two [i.e., first and second] dies images are statistically combined to form a die model, which is subsequently compared with the remaining chips on the wafer under test; also refer to column 5, lines 35-55 and column 6, lines 14-45).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the manner in which Sumie forms his reference die image by forming a statistical die model of a plurality of dies as taught by Schemmel. That is, Sumie (as described above) finds a defect free die to use as a reference by comparing at least first and second dies on a same wafer. When both dies images agree with one another, both are deemed acceptable (i.e., defect free) and one is used as the reference. This ensures that only defect free images are used as a reference. While this is beneficial, as modified by the teaching of Schemmel, it would have been obvious to combine those die images found to be defect free by Sumie to form a statistical die model (i.e., instead of selecting just one of those dies as the reference as is taught by Sumie) in the manner taught by Schemmel. One would be motivated to form a statistical die model as taught by Schemmel to solve "the problem caused by the

inherent defects of CCD cameras" (Schemmel, column 6, line 35), to "increase the resolution of the scan" and factor "in the differences in the background contrast of the silicon wafers" (Schemmel, column 6, lines 58-63), as well as accounting for and being robust against "different batches of silicon wafers" (Schemmel, column 10, line 55), in addition to many other motivating factors described throughout the Schemmel references.

Note: Regarding each of the above claims, it would have also been obvious to modify Schemmel according to the teaching of Sumie. That is, Sumie teaches the concept and comparing dies on a wafer to find defect free dies, and using only a defect free die as a reference for subsequent comparisons. It would have been obvious to utilize only known good dies based on the comparison of Sumie, in order to form the statistical die model of Schemmel, thereby ensuring that defective dies do not contribute to and otherwise taint Schemmel's statistical die model so that the die model is an accurate representation of a good, defect free die.

Regarding claims 57 and 58 specifically, Schemmel teaches all the elements of claim 56, from which claim 57 depends (refer to the 102 rejection above).

Regarding claims 57 and 58, Schemmel does not teach <u>the production of a difference image from the first die image and the second die image. Regarding claim 58 specifically, Schemmel does not teach a difference image analysis system</u>.

As described above, Sumie teaches the concept and comparing and analyzing images of first and second dies on a wafer to produce a difference image, and thereby

find defect free dies. Then, Sumie uses only a defect free die as a reference for subsequent comparisons.

It would have been obvious to incorporate the comparison of Sumie into the reference model creation of Schemmel, and utilize only known good dies to form the statistical die model of Schemmel, thereby ensuring that defective dies do not contribute to and otherwise taint Schemmel's statistical die model so that the die model is an accurate representation of a good, defect free die.

9. Claims 53, 59, 60, 63, 64 and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A) and Schemmel et al. (US 5,943,55a A) as applied to claim 50 above, and further in combination with Miyazaki (US 6,031,607 A).

Regarding claim 53, Sumie as modified by Schemmel does not disclose the difference image analysis comprising a slope detector determining whether the slope of a histogram changes.

Regarding claims 59 and 63, Sumie as modified by Schemmel does not disclose creating a histogram from the image brightness data.

Regarding claims 60 and 64, Sumie as modified by Schemmel does not disclose determining whether a slope of the histogram changes as brightness increases.

Regarding claim 69, Sumie as modified by Schemmel does not disclose the difference image analysis comprising a slope detector determining whether the slope of a histogram changes from negative to positive.

Miyazaki teaches all of these elements. Miyazaki discloses a semiconductor wafer inspection system ("defect inspection system" at column 1, line 7) comprising defect detection circuitry that analyzes a difference image ("difference image is formed" at column 14, line 64) by generating histogram data from the difference image ("difference image providing the brightness histogram" at column 15, line 6; figures 17 and 18) and analyzing the slope of the histogram data to identify a region over which the slope of the histogram changes (first, the initial slope on the dark end of the histogram is analyzed; i.e., "the amount of the slope of this line is calculated to obtain the absolute value" at column 15, line 4; then, a threshold is set in dependence on this slope as described at column 15, line 42-50, and a "portion brighter than a given uniform brightness (threshold value) is recognized as a defect" at column 15, line 34; in the context of this quote, and looking at figure 17 for example, the brightness peaks that appear in the histogram at areas that are greater than threshold "P1" are regarded as defects, or potential defects; if there were no peaks greater than P1, and thus no slope changes after the initial slope, then the difference image would be considered defect free; the peaks appearing in figure 17 that are greater than P1 are changes in the histogram slope, and represent potential defects, thus meeting the claim requirements).

It would have bee obvious at the time the invention was made to one of ordinary skill in the art to analyze the difference image Sumie, using the histogram techniques as taught by Miyazaki, in order to determine whether a defect exists in one of the dies, and thereby gain the benefit of the Miyazaki analysis which "permits the individual setting of threshold value for portion of much noise and portion of less noise, producing the

pattern defect inspection with high accuracy and enlarging the object of inspection" (Miyazaki, column 15, line 55).

10. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A) and Schemmel et al. (US 5,943,55a A) as applied to claim 50 above, and further in combination with Brecher et al. (US 5,544,256 A).

Sumie as modified by Schemmel does not disclose the difference image analysis comprising a slope detector determining whether the slope of a histogram changes.

Brecher discloses a system in the same field of endeavor of optical inspection (see figure 1), and same problem solving area of analyzing a difference image for defects (see "difference image ... corresponding to a defect" at column 13, line 30), comprising the generation of a histogram from the difference image (figure 15; see "distribution of pixels in the difference image" at column 13, line 28) and analyzing the slope of the histogram data (see "interior contrast ratio" at column 13, line 33) to determine a defect (if the interior contrast ratio is high, the "defect is bright" at column 13, line 41). The purpose of this histogram analysis, as stated by Brecher, is to determine from a difference image, whether defect pixels (if they exist) are brighter or darker than the template as described at column 13, lines 25-30. Brecher states that "[f]requently, there is a need to decide whether a defect is dark or bright" (column 13, line 5) in order to decide how serious the defect is through classification (see column 5, lines 5-20). Specifically regarding the slope analysis limitation, Brecher's interior

contrast ratio is equal to $(N_{brighter})/(N_{brighter} + N_{darker})$ as seen at column 13, line 33. The term $N_{brighter}$ refers to the number of pixels in the histogram that are brighter than the template, and the term N_{darker} refers to the number of histogram pixels that are darker than the template. It can be seen from the histogram of figure 15 that there are two modes, and thus two distinct areas under the curve. The left area indicates the number of darker pixels and the right area indicates the number of brighter pixels. Each area is a distribution, having a positive and negative slope. Thus, given the interior contrast ratio equation, one analyzes the existence of the slopes in the difference image histogram as follows. In a case where there are only bright pixel differences, the ratio would be $(N_{brighter})/(N_{brighter} + 0)$ which is equal to one. This happens because there is no dark pixel distribution and thus no dark pixel slopes. In a case where there are only dark pixel differences, the ratio would be $(0)/(0 + N_{darker})$ which is equal to zero. This happens because there is no bright pixel distribution and thus no bright pixel slopes. In the case where there are equivalent numbers of bright and dark pixels, meaning that both distributions appear, each having slopes as seen in figure 15, then the ratio is N/(N+N) which is equal to .5. Thus, as the bright and dark distributions change, the ratio changes from zero to one. When the ratio is one, only bright pixels are present. When the ratio is zero, only dark pixels are present. When the ratio is between zero and one, there is a change from a negative slope of the dark pixel distribution to a positive slope of the bright distribution meaning that there are both bright and dark pixel defects. Thus, Brecher's interior contrast ratio is an analysis of slops present in the histogram, thus meeting the claim requirements. The claims make no specific

requirements regarding the type of analysis, the details of the analysis, or any procedures involved in analyzing the slope, other than that the slopes are "analyzed". None of the claim limitations preclude the Brecher teaching from meeting the claim limitations. In addition, Brecher also determines a negative to positive slope change from the values $\Delta_{positive}$ and $\Delta_{negative}$, which are the average values of the positive and negative difference distributions as seen at figure 15 and described at column 13, lines 35-45. The "average" values exist right at the center of the distributions where the slopes changes from negative to positive. Brecher uses these values to determine an "interior contrast magnitude" at column 13, line 38, which is a "measurement for a defect in a patterned semiconductor wafer" at column 14, line 11, as listed in Table 5, at column 15. Brecher uses this technique to decide whether a "defect is dark or light" (column 13, line 5) in order to classify the defect (column 4, lines 35-50), as defect classification has become an "essential part" of the manufacturing process "where defect detection is critical", as "classification provides the information necessary to correction process or production problems" (column 1, lines 15-25; also refer to columns 14-15).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to combine the teaching of Brecher with Sumie as modified by Schemmel, by generating a histogram from Sumie's difference image and analyzing the histogram for the presence of bright and dark pixel difference slopes as taught by Brecher and described above, to determine the presence of bright and/or dark pixel differences which is "indicative of foreign material on top of the surface" (Brecher, column 12, line

61), and thereby better classify the types of defects present and thus determine seriousness and nature of the defect.

11. Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A) and Schemmel et al. (US 5,943,55a A) as applied to claim 50 above, and further in combination with Michael (US 5,640,200 A).

Regarding claim 54, Sumie as modified by Schemmel does not teach a size detector for determining whether a size of an anomalous region exceeds a predetermined allowable size.

Michael discloses a system in the same field of optical inspection (figure 7) and same problem solving area of determining defects in a difference image (see "difference image" at column 10, line 21) comprising the determination of a defect size within the difference image ("defect size" at column 15, line 60; "measuring ... area" at column 16, line 30; see equations 10a and 10b at line 45). Michael states that use of geometric criteria, such as size and area, impose "additional criteria to prevent false alarms" (column 15, line 58).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to impose size as a defect criteria as taught by Michael, for the determination of potential defects on a die as identified by the difference image of Sumie, in order to impose additional criteria for determining a defect to prevent false alarms, and the false determination of a defect in an otherwise good wafer die.

12. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A) and Schemmel et al. (US 5,943,55a A) as applied to claim 50 above, and further in combination with Berezin et al. (US 5,539,752 A).

Sumie as modified by Schemmel does not teach the calculation of defect density for determining whether a number of anomalous regions per unit area exceeds a predetermined allowable number of anomalous regions per unit area.

Berezin discloses semiconductor wafer inspection (figure 1) wherein Berezin teaches providing a warning when "defect density, or number of defects per die, exceeds preselected parameters" at column 3, line 52, such as "when the number of defects of a certain defect type for a given die exceed a threshold value, or when the defect density for a certain defect type exceeds a threshold value, thereby indicating yield-detracting operations of the manufacturing process" at column 5, lines 5-13.

It would have been obvious a the time the invention was made to one of ordinary skill in the art to compare the density of defects on a die as determined by Sumie and based on Sumie's difference image, with a predefined criteria as taught by Berezin, in order to flag potential defects between dies, and to flag yield-detracting operations of the manufacturing process so that the operator can take corrective action.

13. Claims 61, 65 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A), Schemmel et al. (US 5,943,55a

A) and Miyazaki (US 6,031,607 A) as applied to claim 69 above, and further in view of Michael (US 5,640,200 A).

As applied to claims 59, 63 and 69, The Sumie and Schemmel combination was modified according to the teaching of Miyazaki to analyze the difference image Sumie, using the histogram techniques as taught by Miyazaki, in order to determine whether a defect exists in dies, and thereby gaining the benefit of the Miyazaki analysis which "permits the individual setting of threshold value for portion of much noise and portion of less noise, producing the pattern defect inspection with high accuracy and enlarging the object of inspection" (Miyazaki, column 15, line 55).

However, the Sumie, Schemmel and Miyazaki combination does not teach determining whether a size of an area on the die corresponding to a brightness deviation detected in the histogram exceeds an allowable size.

Michael discloses a system in the same field of optical inspection (figure 7) and same problem solving area of determining defects in a difference image (see "difference image" at column 10, line 21) comprising the determination of a defect size within the difference image ("defect size" at column 15, line 60; "measuring ... area" at column 16, line 30; see equations 10a and 10b at line 45). Michael states that use of geometric criteria, such as size and area, impose "additional criteria to prevent false alarms" (column 15, line 58).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to impose size as a defect criteria as taught by Michael, for the determination of potential defects on a die as identified by the histogram analysis of the

Sumie, Schemmel and Miyazaki combination, in order to impose additional criteria for determining a defect to prevent false alarms, and the false determination of a defect in an otherwise good wafer die.

14. Claims 62, 66, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sumie et a. (US 5,943,437 A), Schemmel et al. (US 5,943,55a A) and Miyazaki (US 6,031,607 A) as applied to claim 69 above, and further in view of Berezin et al. (US 5,539,752 A).

As applied to claims 59, 63 and 69, The Sumie and Schemmel combination was modified according to the teaching of Miyazaki to analyze the difference image Sumie, using the histogram techniques as taught by Miyazaki, in order to determine whether a defect exists in dies, and thereby gaining the benefit of the Miyazaki analysis which "permits the individual setting of threshold value for portion of much noise and portion of less noise, producing the pattern defect inspection with high accuracy and enlarging the object of inspection" (Miyazaki, column 15, line 55).

Regarding claim 72 specifically, Sumie discloses other image data (color data at column 8, line 35)

The Sumie, Schemmel and Miyazaki combination does not teach determining whether a number of areas on the die corresponding to a brightness deviation detected in the histogram exceeds an allowable number of deviations per unit area (i.e., defect density).

Berezin discloses semiconductor wafer inspection (figure 1) wherein Berezin teaches providing a warning when "defect density, or number of defects per die, exceeds preselected parameters" at column 3, line 52, such as "when the number of defects of a certain defect type for a given die exceed a threshold value, or when the defect density for a certain defect type exceeds a threshold value, thereby indicating yield-detracting operations of the manufacturing process" at column 5, lines 5-13.

It would have been obvious a the time the invention was made to one of ordinary skill in the art to compare the density of defects on a die as determined by the histogram analysis of the Sumie, Schemmel and Miyazaki combination, with a predefined criteria as taught by Berezin, in order to flag potential defects between dies, and to flag yield-detracting operations of the manufacturing process so that the operator can take corrective action.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 703-306-3037. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on 703-305-4706. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4750.

Brian Werner
Primary Examiner
May 22, 2003

Brian Werner

BRIAN WERNER
PRIMARY EXAMINER